ELEMENTARY MATHEMATICS.

(1) *Elementary Pure Geometry, with Mensuration.* By E. Buddon, M.A., B.Sc. Pp. viii+284. (London and Edinburgh: W. and R. Chambers, Ltd., 1904.) Price 3*s.*

(2) *Lessons in Experimental and Practical Geometry.* By H. S. Hall, M.A., and F. H. Stevens, M.A. Pp. viii+94+iii. (London: Macmillan and Co., Ltd., 1905.) Price 1*s.* 6*d.*

(3) *The Elements of Geometry, Theoretical and Practical.* By B. Arnett, M.A. Books i., ii., and iii. Pp. viii+195, viii+238, and viii+242. (London: Simpkin, Marshall, Hamilton, Kent and Co., Ltd., 1904.) Price 2*s.* each volume.

(4) *The Elements of Trigonometry.* By S. L. Loney, M.A. Pp. xii+339+xiv. (Cambridge: The University Press, 1904; London: Macmillan and Co., Ltd., 1904.) Price 3*s.* 6*d.*

(5) *Elementary Algebra, Part II.* By W. M. Baker, M.A., and A. A. Bourne, M.A. Pp. viii+277 to 468+lxxvi. (London: George Bell and Sons, 1904.)

(6) *Clive's Shilling Arithmetic.* Edited by W. Briggs, LL.D., M.A., &c. Pp. viii+154. (London: W. B. Clive, 1905.) Price 1*s.*

(7) *Graphic Statics.* By T. Alexander, C.E., and A. W. Thompson, D.Sc. Pp. viii+50. (London: Macmillan and Co., Ltd., 1904.) Price 2*s.*

(1) THE geometry of Mr. Buddon is a notable addition to the elementary text-books which owe their appearance to the freedom of the last few years. The subject is introduced by experimental work, very suggestive in character, and leading by induction to fundamental definitions and theorems. Thus from the sliding and folding of flat cards and the like the author arrives at his definition of a plane as "a surface, infinite in extent, which can be folded about any two points of the surface so that one part lies entirely on the other." The definition of a straight line naturally follows as the infinitely extended fold of a plane. A plane angle is clearly and rationally defined. Parallel lines are those having the same direction in a plane, direction being measured by the angle made with any reference line. It is pointed out that a plane, a plane angle, and a straight line can in each case be reversed on itself, and thus symmetrical properties are satisfactorily established in which the two halves are alike but of opposite aspect. Then follow general cases of congruence. In dealing with ratio and proportion the idea of a continually subdivided decimal scale is introduced; this enables all numbers which can be expressed as continuous decimal fractions, *e.g.* 1·4142. . . ., to be included, and to any degree of approximation. In later chapters the subject-matter comprises a very full treatment of the properties of circles; elementary trigonometry; an introduction to projective geometry; conic sections treated by modern methods; and solid geometry with the mensuration of the simple geometrical solids. The book contains in profusion sets of graphical and deductive exercises. The figures are drawn with thick, thin, and dotted lines on a systematic plan to distinguish more readily between the data, the construction lines, and the result. The use of variable type serves to differentiate parts of greater or less importance. In fact, the book on every page bears witness to the great care and thought bestowed on its production. There is a stimulating freshness in the matter and its method of presentation. Some will doubt the wisdom of carrying on at school the study of pure geometry to the extent covered in the book; others may wish that the geometry of vectors had been included; but all will agree that the author has produced one of the most important of the new elementary text-books, and one that should be known to every teacher interested in the subject.

(2) The "Lessons in Experimental and Practical Geometry" by Messrs. Hall and Stevens might very fittingly be incorporated in the authors' "School Geometry," to which it forms an excellent introduction as well as supplement. The subject is treated in the masterly way that is found in the mathematical text-books of these writers. Young pupils are fortunate who obtain their first notions of geometry from a course such as the one outlined in its pages. They will become accustomed to the use of compasses, squares, scales, and the protractor by interesting quantitative and experimental work, fundamental propositions being at the same time inductively established. They will have practice in the application of geometrical problems; will learn how to measure areas; and will be introduced to the simpler geometrical solids. The authors make good use of tracing paper. The list of instruments and apparatus which they give might with advantage have included the drawing and compass pencils, with a caution added against the employment of soft blunt leads.

(3) In the preface of his elementary geometry Mr. Arnett states that the work "has been written for the use of candidates who are being prepared by a master for the different examinations conducted by the universities and the Civil Service Commission." The subject-matter is confined to plane geometry, and is almost wholly deductive. The first book gives definitions and axioms, and investigates some of the properties of lines, angles, parallels, triangles, and quadrilaterals. The second book deals mainly with the circle and with ratio and proportion, and the last book treats of areas and of similar figures. The principal feature of the work is the very large number of exercises provided, a few of which are numerical or graphical, the great bulk, however, being of the nature of geometrical riders. The text-book is not at all suitable for beginners, for general school work, or for private study except under the direction of a tutor who could direct the student as to which parts should be read and which omitted, and who would probably re-arrange the order in which the theorems and problems should be taken.

(4) Mr. Loney's "Elements of Trigonometry" is mainly taken from part i. of the author's "Plane Trigonometry," and is designed as an easier text-book. The subject is treated in the usual way, and there is nothing to call for special mention. The first chapters relate to acute angles and right-angled

© 1905 Nature Publishing Group

triangles. The definitions are then extended to angles of any magnitude, and formulæ are established for the sum and difference of angles, and for multiple and submultiple angles, &c. There is a chapter on logarithms, and a number of four-figure tables are given. This work leads up to the properties and solution of triangles with applications. Inverse functions are introduced, and general expressions established for angles having given trigonometrical ratios. There are a large number of examples, any necessary answers to which are given at the end of the book.

(5) Part ii. of Messrs. Baker and Bourne's excellent algebra begins by formally establishing the laws of operation of algebraical symbols. It contains chapters on surds and indices, proportion, logarithms, progressions, series, scales of notation, permutations and combinations, the binomial theorem, interest and annuities, exponential and logarithmic series and partial fractions. There are numerous groups of examples, and special sets of revision papers at intervals, the answers being all given in an appendix. A special feature of the book is the frequent use of graphs and of geometrical illustrations. This text-book must give satisfaction wherever used.

(6) Clive's shilling arithmetic is intended for the use of teachers who adopt almost entirely the oral method of instruction, and who only require a class-book containing concise statements of rules, with graduated sets of exercises, and with the formal proofs of theorems omitted. Thus a small volume is sufficient to cover the range of subjects usually taught in schools, and which this manual contains. The book can be obtained with answers included at an extra cost of threepence.

(7) In the graphical statics of Messrs. Alexander and Thompson the authors first give a set of sixteen graduated problems on coplanar forces, solved by means of force and link polygons; these include couples, centres of area and moments of inertia of beam sections. Then follows a set of seventeen examples showing applications to roof trusses, girders, walls, and masonry arches. The treatment is somewhat fragmentary and arbitrary, but, if supplemented by the teacher, the course would prepare a student for a systematic study of graphic statics, and the book is intended more particularly as an introduction to the author's "Elementary Applied Mechanics."

SALT-BEDS AND OCEANS.

Zur Bildung der ozeanischen Salzablagerungen. By J. H. van 't Hoff. Pp. vi+85. (Brunswick: Vieweg and Son.) Price 4 marks.

THIS work will be welcomed alike by chemists, geologists, and oceanographers. It forms the first instalment of the collection into one publication of the results of some forty memoirs of the author and his collaborators on the formation of double salts.

The principal object of the work was the study of the problem of the natural salt beds. As these beds have in all probability been formed by the evaporation of a body of water comparable with the existing oceans, which certainly contain some of everything, it was necessary to set limits to the investigation. This was effected by confining attention to the principal constituents of the salt-beds. These are chloride of sodium, in great preponderance, and the chlorides and sulphates of magnesium and potassium with their water of crystallisation. The latter form a series of more complex bodies which appear and disappear with the changing equilibrium of the solution. After these come the calcium salts, such as anhydrite and polyhalite; but they are held over for treatment in the next fascicule.

The work is a gigantic exercise in physical chemistry, which the author carries through on strictly scientific lines, while at the same time touch is kept with the important applications of his results in the economy of nature, and chemistry is thus vindicated as a branch of natural history.

The experimental part of the work is of especial interest to physical chemists, and the publication of it in a connected and condensed form will be welcomed by them. It is proposed here to notice only the application of it to the occurrence of salts in nature in beds and in solution.

The experimental basis of the work is the determination of the solubility, at certain temperatures, of the common salts of the sea, in water and in solutions of each other. With the information so obtained, it is possible to follow exactly the crystallisation of a solution containing all these salts, as it gradually loses water by evaporation at the temperature of the experiment. The temperature most used is 25° C., which is fairly representative of the temperature of sea water evaporating in salt gardens, such as those of Hyères or Cadiz in summer.

When average sea-water has been evaporated down to the point at which chloride of sodium begins to crystallise, the liquor contains (in molecular proportions) 100 $NaCl$, 2·2 KCl, 7·8 $MgCl_2$, 3·8 $MgSO_4$; and this mixture of salts is associated with, roughly, 1000 mol. H_2O (exactly 1064). On allowing this liquor to evaporate at 25° C., the crystallisation follows a definite route, which can be traced exactly, and without difficulty, on one of those marvellous charts representing the march of physical and chemical phenomena with which the resourceful inventiveness of van 't Hoff has familiarised us.

The crystallisation takes place in four acts corresponding to the regions in the chart.

(1) Rock-salt: separation of chloride of sodium in great abundance. Of the 100 $NaCl$ present when crystallisation began, only 4·6 $NaCl$ remains dissolved; the remainder, 95 $NaCl$, has been deposited.

(2) Kieserite region: separation of chloride of sodium, sulphate of magnesium, and kainite

$$(MgSO_4KCl3H_2O).$$

The salt separated in this act consists of 4·42 $NaCl$, 2·02 KCl, and 3·07 $MgSO_4$; or, 4·42 $NaCl$, 1.05 $MgSO_4$, and 2.02 kainite.

(3) Carnallite region: separation of chloride of sodium, carnallite ($KMgCl_3,6H_2O$), and kieserite ($MgSO_4.H_2O$), and the amounts separated are 0·03 $NaCl$, 0·1 carnallite, and 0·35 kieserite.

(4) Final liquor: what remains solidifies to 0·15

© 1905 Nature Publishing Group